

Water Powers of Canada

**The
Province of Quebec**



By F. T. Kaelin

"An examination of any good map of our broad Dominion, reveals, as its most striking feature, an extraordinary wealthy and remarkably uninterrupted succession of lakes and rivers, suggestive of ample rainfall, the first great requisite in the occupation of any country. Over a length of several thousand miles, between Labrador and Alaska, and over a width of several hundred miles, there is an almost continuous distribution of lakes; lakelets and rivers; the lakes of varied outlines, dimensions and elevations above sea level, and many possessing facilities for the storage of their flood waters. In many places the outlet from the lake or the connection between a chain of lakes is a narrow cleft in rock where an inexpensive dam will hold back the water supplied by the winter's accumulation of snow."



From a Presidential address on the Water Powers of Canada before the Royal Society of Canada, in 1898-99, by the late T. C. Keefer, C.E., C.M.G., Honorary Member of the Institute, American Society and Canadian Society, of Civil Engineers; Past President of the American and Canadian Societies of Civil Engineers.

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By F. T. Kaelin



Dominion Water Power Branch
Department of the Interior
Ottawa, Canada

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THIS monograph on the Water Powers of the Province of Quebec, published by direction of the Honourable W. J. Roche, Minister of the Interior, Canada, was written by Mr. F. T. Kaelin, Assistant Chief Engineer, Shawinigan Water and Power Company, Montreal, at the request of the Superintendent of the Dominion Water Power Branch, for distribution in connection with the water power exhibit of the Dominion Government in the Canadian Building at the Panama-Pacific Exposition.

This water power exhibit was prepared by the Dominion Water Power Branch under the direction of the Commissioner General of Canadian Exhibitions, with the object of showing visitors to the Exposition the tremendous water power resources of Canada, and especially the great progress already made in the art of power development and use throughout the Dominion.

The outstanding feature of the water power situation in Canada is the fact, that practically all industrial and commercial centres in the Dominion, from coast to coast, have sufficient potential water power within easy transmission radius and of sufficient capacity and assured economic feasibility of development to meet all anticipated requirements for the future.

INTRODUCTION

THE present age has been called by a prominent Engineer "The New Epoch," inaugurated by the manufacture of power, and it is certainly true, that the use of power is the great central pivot, around which every activity and industry swings to-day.

It is now well recognized that the most valuable resources of a country, are those which afford the means of manufacturing cheap power.

These resources are, falling water, the coal mine and the oil field.

Of these resources, falling water or water powers, stand out as being inexhaustible, and therefore one of the most valuable assets of any country. A time must come when the supply of coal and oil will become limited, and the best way to conserve these fuel supplies is to make use of our water powers in their stead.

Any country which possesses such large water powers as Canada, and especially the Province of Quebec, is destined to play a very important role among industrial nations, always deriving wealth and prosperity from such resources if developed with energy and foresight.

The opening up of our large resources, such as mines and forests, largely depends upon the cheap and bountiful supply of power, made possible by the development of our enormous quantities of falling waters.

The fast growing importance of the water powers of Quebec Province may be realized by reviewing a brief collection of facts regarding its natural resources and industrial facilities.

The Province of Quebec is situated in the eastern part of the Dominion of Canada. Bounded on the east by the Atlantic Ocean, and traversed through its entire length by the St. Lawrence River, it possesses all the advantages of both a maritime and an inland country. Being in the temperate zone the climate is highly favorable. Its superficial area is 351,873 square miles, being almost equal to France and Germany combined.

In 1911 the population of the Province of Quebec was 2,002,712, most of whom are concentrated in the districts surrounding Montreal, Three Rivers, and Quebec. More than half of the inhabitants practise mixed and dairy farming, the majority of the remainder being engaged in industrial pursuits.

There are immense forests, the area of timber limits leased being over 66,000 square miles, and the supply of hard woods, cedar, spruce and pine is almost inexhaustible.

The mineral resources of the Province are considerable. Its asbestos mines are the best and richest in the world, and gold, copper and iron are also extensively mined.

The principal manufactures are, shoes, textile goods, paper, railway equipment, bricks and cement.

Besides enjoying the services of both ocean and inland steamship lines, the manufacturing districts of Quebec Province are well served by various Railway Companies, and the number of miles of railways now totals more than 4,330, of which 300 miles are operated electrically.

According to Government investigation, the available water powers of Canada amount to 17,000,000 h.-p., of which 5,600,000 h.-p. are in Quebec Province.

These figures constitute a very conservative estimate and could be materially increased, if the flow of some of the rivers were regulated by arranging suitable storage reservoirs for the water.

The pending construction of a new dam on the St. Maurice River at a cost of \$1,500,000, to regulate the flow of water to various power plants in the Three Rivers District, may be cited as an example of such conservation of water-power.

This dam will be situated 240 miles north of the St. Lawrence River, and will enable the storage of a tremendous volume of water by raising the water level in a number of lakes and flooding some otherwise useless territory. The total area of these lakes and flooded ground is about three hundred square miles.

The flow from the dam will be regulated to suit the demands for water throughout the year, thus providing the power plants with a steady supply and rendering their output largely independent of the time of year, by storing water during the flood seasons, and permitting an outflow during the drier seasons.

The sources of water powers of immediate importance and interest in Quebec Province, are those within easy reach of the Ottawa, Montreal, Three Rivers and Quebec Districts.



WATER POWERS OF QUEBEC

OTTAWA DISTRICT

IN the Ottawa District, where a portion of the Ottawa River and a number of its tributaries run their courses in this Province, there are many falls and rapids, most of which are still undeveloped. The Quinze River, which is eighteen miles in length, and really a portion of the Ottawa River, flows near the Cobalt mining district, and has its course broken by fifteen rapids from which its name is derived.

There is a considerable demand for power in this region, and of the 90,000 available horse-power on the Quinze, none whatever is developed at the present time.

The Lievre River, one of the principal tributaries of the Ottawa River, has a drainage area of 4,000 square miles containing a number of large lakes, and has a series of falls and rapids. The total available horse-power is estimated at 85,000, of which less than 10,000 h.-p. is developed to date.

A still larger tributary of the Ottawa River is the Gatineau River, with a length of 225 miles and a drainage basin of 9,500 square miles. The Gatineau enters the Ottawa River at Ottawa, and its falls and rapids are capable of generating 225,000 h.-p., none of which is utilized at present, although some developments are contemplated in the near future with a view to starting a pulp and paper industry, for which the locality is ideal.



High Falls, Lievre River.



Chaudiere Falls, Chaudiere River



Power House of Cedars Rapids Manufacturing and Power Company.

The Carillon Rapids on the Ottawa River, between Quebec and Ontario Provinces, is capable of developing 160,000 h.-p. It is important on account of its proximity to Montreal.

There are several smaller rivers in the Ottawa District whose falls and rapids could be turned to great industrial use.

MONTREAL DISTRICT

THE Montreal District embraces that portion of the St. Lawrence and its tributaries on both shores between the Rivers Ottawa and St. Maurice. The only large water powers in this region are on the St. Lawrence, although there is considerable available power on various tributaries, some of which is already developed. The Cedars and Cascade Rapids situated about thirty-five miles from Montreal on the St. Lawrence, and having a fall of thirty feet, are capable of generating 500,000 h.-p. At present developments are being carried out by the Cedars Rapids Manufacturing & Power Company, and when complete will have an output of 180,000 h.-p.

The present installation comprises nine turbine units of the vertical type, each developing 10,000 h.-p. of which 60,000 h.-p. is being transmitted to Aluminum Works at Massena, and the remainder to Montreal.

On the opposite side of the St. Lawrence, the Canadian Light and Power Company's plant at St. Timothee is furnishing about 20,000 h.-p. to Montreal mainly for the Tramways. This development when completed will consist of ten 5,000 K.W. generators, 50,000 in all.



Power House of Canadian Light and Power Company, St. Timothee.

A development on the Soulange Canal, close to Cedars Rapids, furnishes 13,000 h.-p. or consumption in Montreal, in addition to sufficient power for lighting the canal and operating the locks.

Still nearer to Montreal, on the St. Lawrence, is Lachine, annually visited by thousands of tourists and pleasure seekers, for the purpose of shooting the rapids. The total available horse-power of these rapids is estimated at 400,000, and the water rights have already been purchased. There is an existing power plant on the Lachine rapids which supplies 13,000 h.-p. to Montreal.



Forebay-Canadian Light and Power Company, St. Timothee.

At Chambly, on the south shore of the St. Lawrence, about sixteen miles from Montreal, here is a hydro-electric plant on the Richelieu River, providing Montreal with 20,000 h.-p. or light and power purposes.

Numerous small developments near Montreal supply power to flour mills, rolling mills, textile and other factories.

Moreover, Montreal not only receives electrical energy from the afore-mentioned local points, but also from Shawenegan Falls, situated nearly 100 miles distant on the St. Maurice River, in the Three Rivers District, and at the present day, an aggregate of 126,000 h.-p. is supplied to Montreal by falling waters.

Of the still available power around Montreal, 240,000 h.-p. can be easily developed as the demand arises.

In the more distant future, some of the falls and rapids which do not lend themselves to such easy development, may also be harnessed and turned to industrial uses.



Shawenegan Falls. St. Maurice River.



Le Gres Falls, Three Rivers.

Having considered the leading sources of power in Montreal district, it is not difficult to realize that this City enjoys a more bountiful supply of cheap power than any other City in the world. No City has such advantages to offer the Manufacturer whose business involves the consumption of a large amount of power, as Montreal, and those contemplating the erection and operation of new factories would do well to investigate the facilities offered by this district, favoured by its location as a seaport and as a centre for abundant water powers.

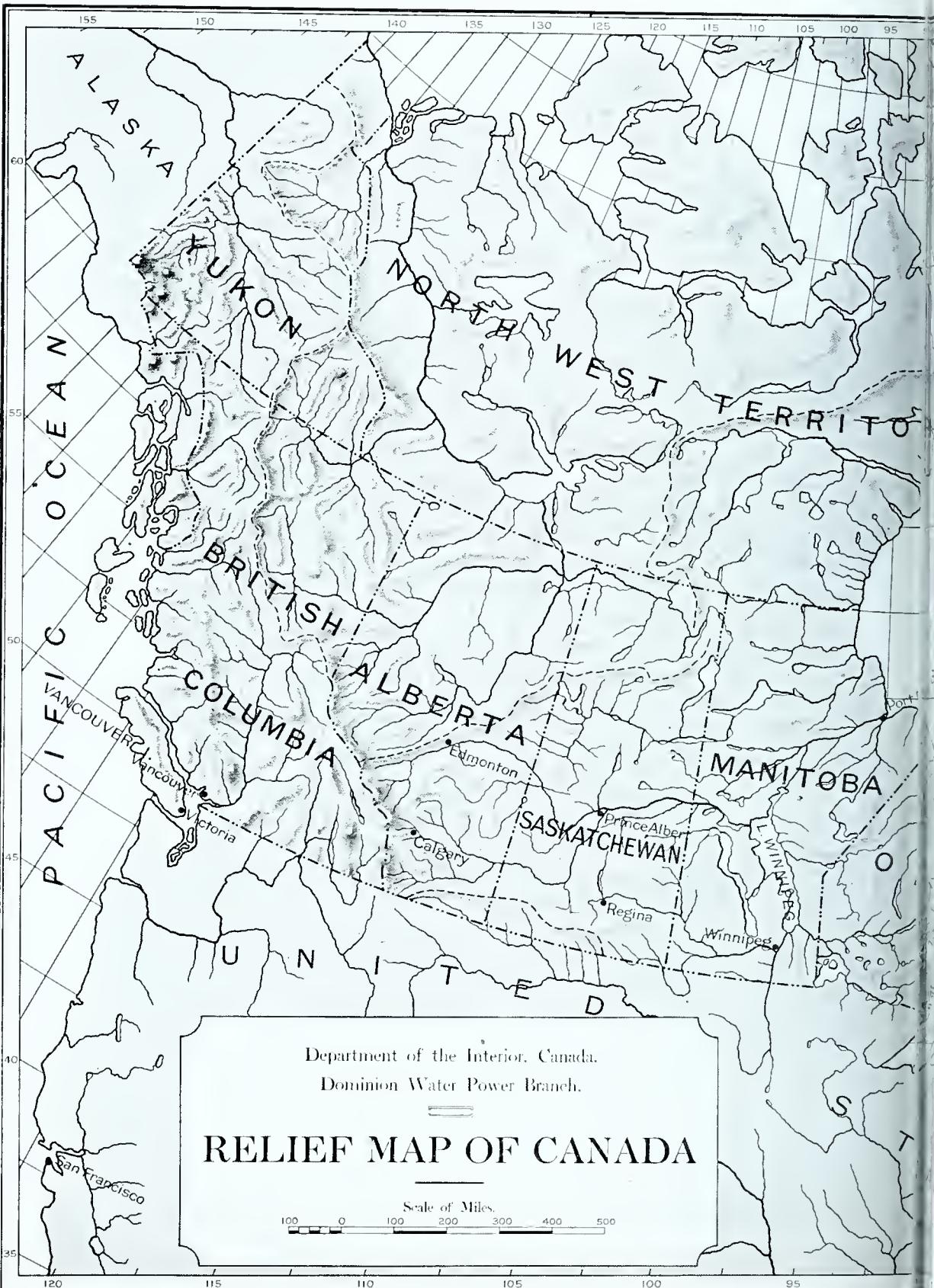
THREE RIVERS DISTRICT

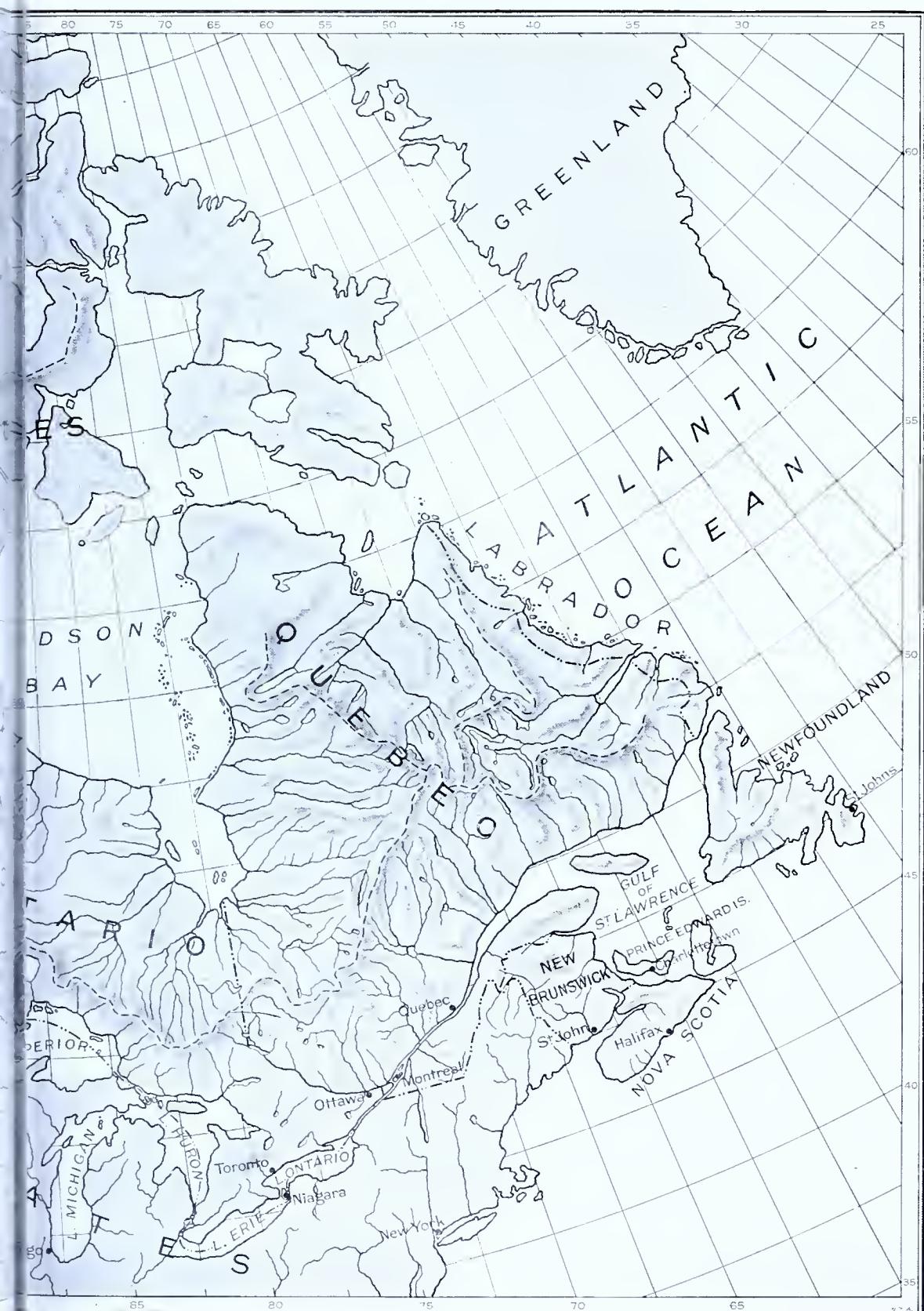
LEAVING Montreal, and following the St. Lawrence in an easterly direction for seventy-five miles, we arrive at the City of Three Rivers, where the St. Maurice River ends its course.

The St. Maurice has a length of 300 miles, and its drainage area, including many large lakes, totals 3,600 square miles. It flows through richly timbered areas, and an enormous amount of lumber is carried down by it annually to the pulp and paper and lumber mills



Dam at Shawenegan Falls, Quebec.





upon its banks. Its course is broken by a dozen falls and rapids which will be capable of developing 650,000 h.-p. when the upper St. Maurice dam, previously referred to, is completed. The most southerly water power on the St. Maurice is situated at Le Gres Falls, fifteen miles north of Three Rivers, where 60,000 h.-p. is available, none of which is utilized at present.

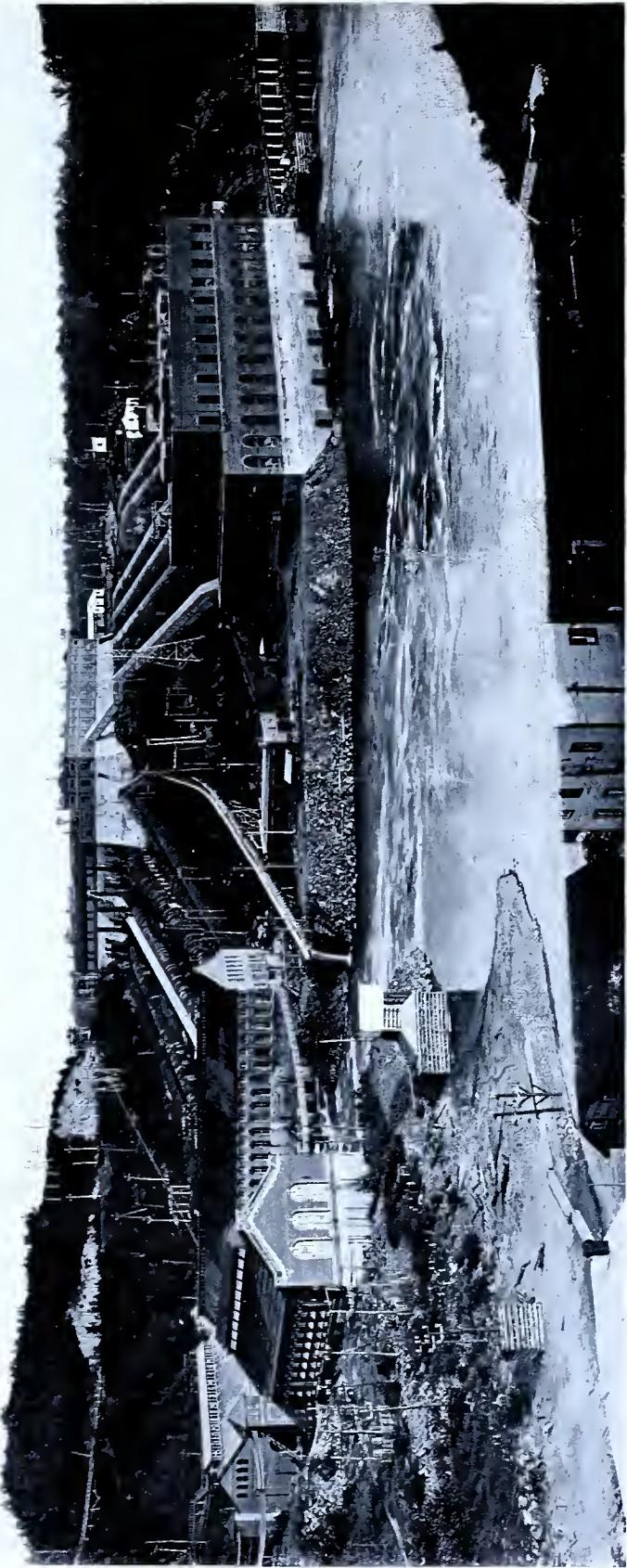
Shawenegan Falls, twenty-one miles from Three Rivers, is the scene of the next hydro-electric plant on the river. This constitutes an ideal place for water power development, nature seeming to have intended it for that purpose. Not only is there an available high head and a large quantity of water with fairly constant flow, but the river widens into a lake



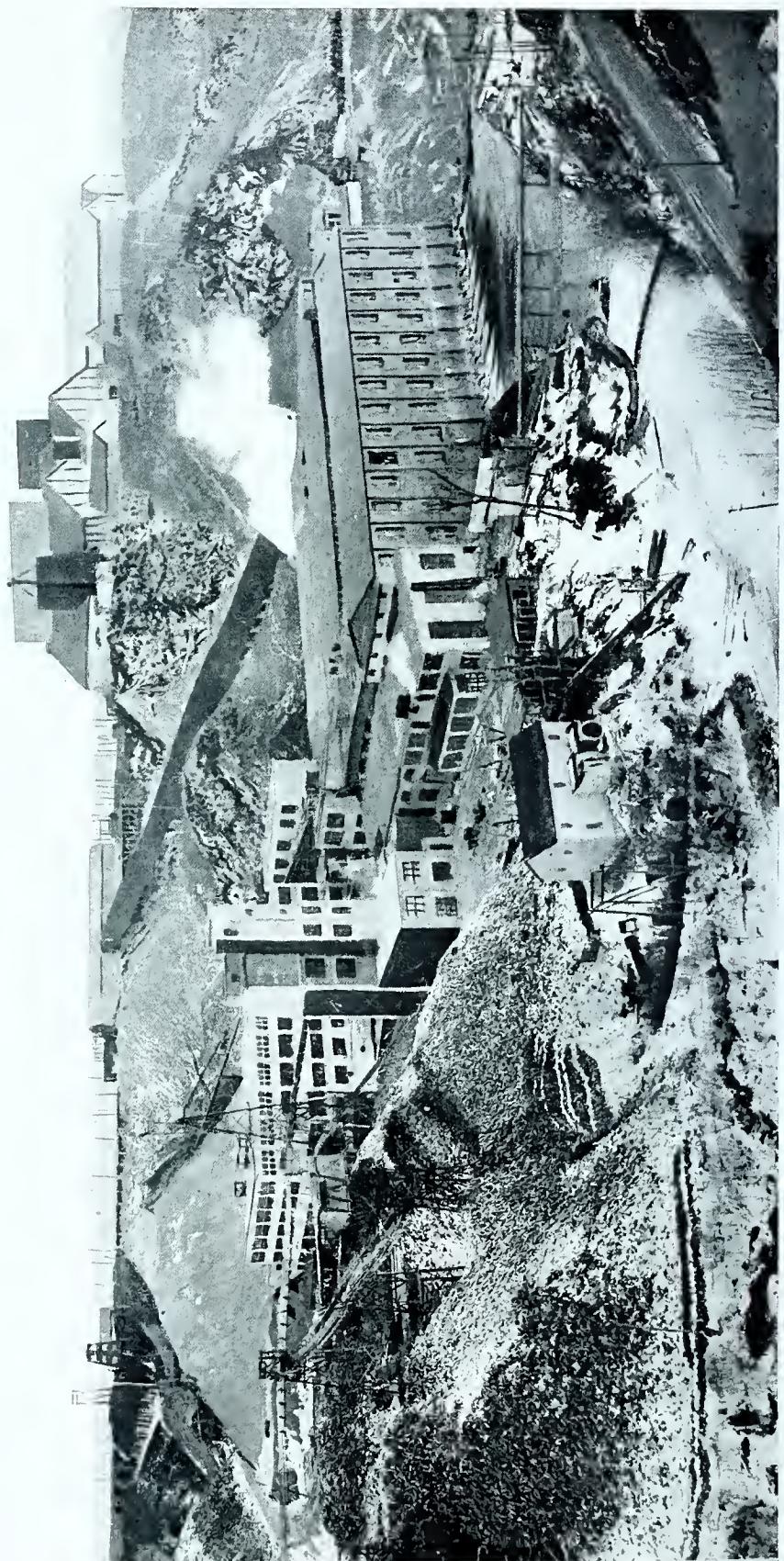
Gorge below Shawenegan Falls, St Maurice River.

just above the falls, and after making a sharp bend forms a second lake 145 feet below. This brings the upper and lower water-levels within a short distance of each other, thus providing an extremely economical location for the power plant at the bottom of the slope between them.

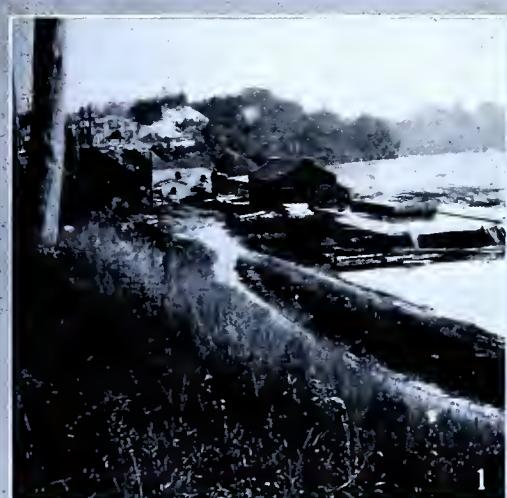
The entire water rights of Shawenegan Falls are owned by the Shawenegan Water & Power Company, which sells a portion of the water to local manufacturing concerns for their own use and operates its own large power plant with the remainder. This plant is capable of generating 155,000 h.-p. Some of this power is used at Shawenegan Falls for the reduction of aluminum, the manufacture of carbide, cotton and other goods, but the larger portion is transmitted to Montreal, Three Rivers and various smaller towns, factories and mines in the district.



Power Development at Shawinigan Falls.



Belgo-Canadian Pulp Company, Shawinigan Falls.



1



2



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4



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6

1. Old Intake, Shawenegan Falls.
2. Belgo-Canadian Pulp Company, Shawenegan Falls.
3. Log Chute, Shawenegan Falls.
4. Traffic Bridge, Shawenegan Falls.
5. Aluminum Works, Shawenegan Falls.
6. C.P.R. Bridge Across Gorge.

The flourishing town of Shawenegan Falls, with a population of 5,000, owes its existence entirely to the presence of the hydro-electric power there. This town is served by both the Canadian Pacific and the Canadian Northern Railways, and with its abundance of water power, constitutes an ideal locality for the manufacture of products involving electro-chemical processes.

Situated twelve miles above Shawenegan Falls, on the St. Maurice, is Grand Mere Falls, with a head of 75 feet. This power site is controlled by the Laurentide Company, but when developments are complete the output of the generating plant will be far in excess of the power required by their paper mills. The available power at Grand Mere amounts to 100,000 h.-p., all of which will be developed upon completion of extensions to the plant now under way.

The output of the Laurentide Mills, which consume 30,000 h.-p., is about 250 tons of paper daily.

About 103 miles from Three Rivers, on the St. Maurice, at La Tuque, there is a 70 foot water fall capable of generating over 75,000 h.-p. The existing pulp mills at La Tuque are using only 3,500 h.-p., thus leaving over 70,000 still available.

There are a number of water powers on the St. Maurice north of La Tuque, which still belong to the Crown, and are available for future development.

Considering that all the large powers on the St. Maurice are within easy reach of Three Rivers, it is at once apparent what a unique location as regards manufacturing facilities is enjoyed by that City.

Three Rivers is a port of call for both River and Ocean boats, and it is also located on the Canadian Pacific Railway main line connecting Montreal and Quebec. The population of Three Rivers is 19,000, and as well as being the commercial centre of a farming district with 500,000 inhabitants, it is essentially a manufacturing City, and large amounts of pulp and paper and cotton goods are produced there annually.



General View of Power Developments, Grand Mere, St. Maurice River.



Grand Mere Falls, St. Maurice River.



Laurentide Mills, Grand Mere. New Turbines are 20,000 h.-p. single runner



La Tuque Falls, St. Maurice River.



Montmorency Falls, Montmorency River.

CITY OF QUEBEC DISTRICT

ALTHOUGH a vast amount of water power is available in the region directly north of Quebec City, a comparatively small quantity only has been developed. The electrical supply for Quebec City is at present only partly obtained from a number of nearby small developments, mainly on the north shore of the St. Lawrence. The larger water powers in this district are practically to be found upon rivers flowing to or from Lake St. John, and especially upon the Saguenay River, which connects Lake St. John with the St. Lawrence.

The junction of the Saguenay with Lake St. John is situated about 120 miles due north of Quebec City, which is connected with the various places on the shore of the Lake and the Saguenay, by the Quebec and Lake St. John Railway.

This district is famous for the variety of sport in the nature of hunting, fishing and boating, which it has to offer, and is consequently scattered with a number of holiday resorts. Lake St. John has an area of 350 square miles, and a tremendous volume of water flows therefrom, down the Saguenay.



Ouiatchouan Falls, Ouiatchouan River.

At Grand Discharge, where the lake empties its waters into the Saguenay, there are two main falls, which are capable of generating 375,000 h.-p., and the water rights have been secured by the Quebec Government, who have in view a storage scheme whereby the above available power would be increased to over 1,000,000 h.-p. Construction work on this development is expected to commence in the near future.

Some 20 miles below the Grand Discharge, is a series of rapids having an available power of over 240,000 h.-p., none of which is yet developed. At Chicoutimi, a few miles farther down the Saguenay, where it is joined by the Chicoutimi River, a hydro-electric plant is developing 7,500 h.-p., which represents about half of the power available. From Chicoutimi down to the St. Lawrence, the Saguenay is navigable. There are considerable available water powers on some other tributaries of the Saguenay, chief of which are the Shipshaw River with 8,000 h.-p. available, some of which is being developed, and the Perabouka River with 120,000 h.-p. available.

A number of tributaries of Lake St. John, flowing from all directions, have their courses broken by numerous falls and rapids, which might be turned to great industrial use, although but small demand has yet arisen for these powers.

Of those rivers running into Lake St. John, the most important from an industrial standpoint, are the Ashwampuchuan River with 250,000 h.-p. available.

The Mistassini and Muskosibi Rivers each with 12,000 h.-p., the Metabetchouan River with 11,000 h.-p. available, and the Ouiatchouan River, whose falls are capable of generating 13,000 h.-p., of which 5,000 h.-p. is already developed.

It will now be apparent that a vast amount of power is obtainable in the Lake St. John region, most of which could be transmitted electrically to Quebec City, if desired, or used on the spot for electro-chemical processes and other purposes. This district is also richly timbered, and should prove attractive to those interested in the pulp and paper industry.

MISCELLANEOUS POWERS

ON the north shore of the St. Lawrence, between the Saguenay and the Atlantic Ocean, the country is scattered with large water powers which, like the district itself, are entirely undeveloped.

The principal rivers in this region are the Hamilton, Netashkwan, Romaine St. John, Manitou, Manikuagan, Outards, Bersimis and Portneuf, and the total amount of available power is well over a million horse-power.

Fast flowing rivers are comparatively scarce on the south shore of the St. Lawrence, the River de Loup, the Magdalen River, being the only ones east of Quebec with available water powers. The mouth of the River de Loup is almost opposite that of the Saguenay, and its Falls at Fraserville are capable of developing 3,500 h.-p., of which 500 h.-p. is at present utilized.

The Magdalen River, which joins the St. Lawrence much farther east, has a series of rapids and falls with an available power of 50,000 h.-p., none of which is yet developed.



Falls and Village at Indian Lorette.



Lower Fraser Falls, Murray Bay.



Bic Falls, Bic River.



Falls at Fraserville, Riviere du Loup.

The remaining water powers of Quebec Province are scattered over the James Bay Slope, where such large rivers as the Harricanaw, Nottaway, Rupert and Eastmain run their courses. The available water power in this region is estimated at nearly a million horse-power.

STATEMENT OF UNDEVELOPED AND DEVELOPED WATER POWERS

AS far as it is possible to ascertain from existing figures the total developed water power in the Province of Quebec, amounted at the beginning of 1915 to 520,000 h.-p.

Of this power, about 370,000 h.-p. is used in the form of electrical energy, 100,000 h.-p. as mechanical power for the pulp and paper industry, and about 50,000 h.-p. for other industries. This developed power represents less than 10% of that available, and the development of any considerable portion of the remaining water powers, constitutes a gigantic task for the engineers of this country.

From the foregoing pages it will be seen that among the developed water powers are small as well as large ones distributed over a large portion of the Province, but especially in the vicinity of industrial centres, near the St. Lawrence River.

Those water powers within short distances of industrial centres and capable of easy development were naturally the first utilized.



Falls, Riviere du Loup, Quebec.

The proximity of industrial centres, however, is now a secondary consideration, owing to recent achievements in long distance transmission, and the ease with which water powers farther afield can be utilized is now apparent.

We may consider then from the foregoing that the value of a water power depends on:—

1. Natural advantages such as volume of water, steadiness of flow, height of fall, and the special natural disposition favourable for cheap development.

2. The location of the water power in regard to the market. This market might consist in the pulp and paper industry, and in this case would depend on the proximity of forests and timber limits.

Pulp and paper mills are usually situated on power sites.

A market for power also exists near big industrial centres, where it is required for lighting, manufacturing and transportation purposes.

This market is of course more or less confined to the larger cities near the St. Lawrence, and consequently most of the water powers around Montreal have already been developed.

GOVERNMENT POLICY

THREE are various ways of improving the value of water powers not yet developed, and as such improvements are to the advantage of the country in general, the Government of the Province of Quebec has inaugurated a far reaching policy, promoting the conservation of water powers.

Among the most necessary and beneficial steps to enhance the value of our water powers, may be mentioned:—

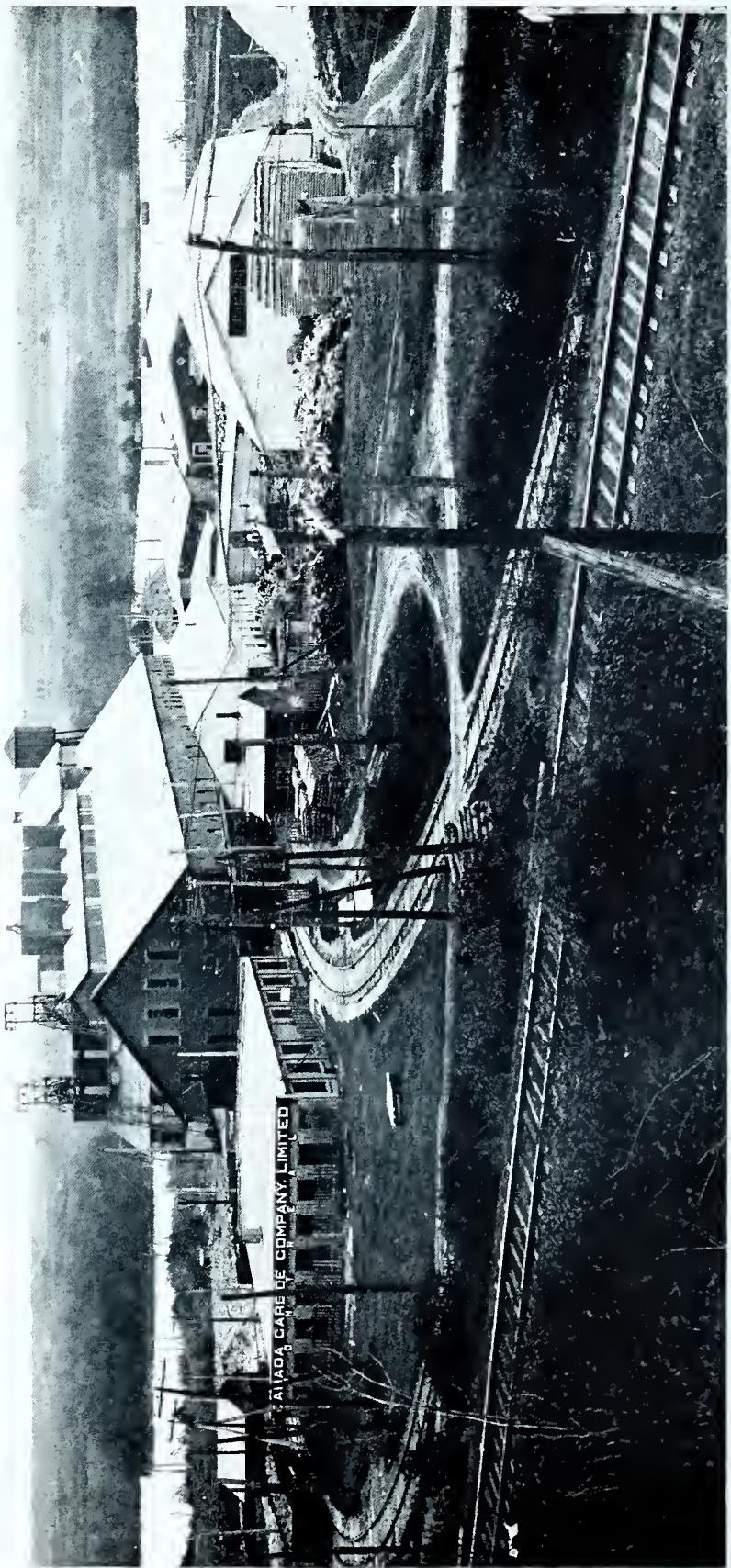
1. A more complete and reliable measurement of the flow of our rivers and streams at the different periods of the year.

2. The establishment of more meteorological observation stations which would give us a better idea of the precipitation in different parts of the country, and therefore the qualities of run-off.

3. The survey of water powers and possible storage reservoirs and the preparation of profiles of the water courses.

Where a number of small water powers exist on the same river, their consolidation should be encouraged as much as possible, to ensure a development capable of utilizing all the available power. In this way each power plant would be able to generate as far as is practicable all the power available on that portion of the river between itself and that plant above it.

If Companies select their own power sites without having due consideration for the future, much power may be rendered unavailable for other generations, whilst they themselves are not materially benefitted.



FUTURE USES OF POWER

THE enormous amount of undeveloped water power in the Province of Quebec arouses conjecture as to how this power will be used in the future.

It is evident that some water powers are more suitable than others for certain purposes, hence it is obvious that water powers within 200 miles of the larger cities and the St. Lawrence River will be used mainly by the rapidly growing manufacturing industries and for the production of light and heat.

Closely related to the growth of industries are manufacturing facilities, especially suburban traffic, and the connection of leading commercial centres by electric railways.

It is also clear that the electrification of our big steam railways is only a matter of time.

Electro-chemical and thermo-electric processes for the production and refining of various metals, such as aluminum, magnesia, the various steel alloys, carbide, potash, cyanides, etc., constitute another extensive field for the use of our water powers.

One of the most important future uses will be the production of nitrogenous products, so essential to the fertilization of our food lands.

When the soil in the great prairies of the West has become impoverished, the greatly increased population will still depend upon the continuance of food-producing qualities of the soil, and artificial fertilizers will become essential, it is then that our enormous water powers away near James Bay and Labrador, will prove a never-failing source of elements necessary for the replenishment of the soil, and in reality it is on our water powers that future generations will largely depend for their food supply.

In conclusion, it is desired to tender cordial thanks to the following Companies for the loan of photographs herein reproduced:—

The Cedars Rapids Manufacturing & Power Company.

The Belgo Canadian Pulp & Paper Company.

The Canadian Northern Railway Company.

The Shawenegan Water & Power Company.

The Canadian Light & Power Company.

General Passenger Department, Intercolonial Railway of Canada.

MANNER OF OBTAINING AUTHORIZATION FOR THE DEVELOPMENT OF WATER POWERS IN THE PROVINCE OF QUEBEC

By Arthur Amos, C.E., Chief Engineer Hydraulic Service, Department of Lands and Forests, Quebec.

TO obtain authorization for the utilization of a water power in the Province of Quebec, application must be made to the Honourable Minister of Lands and Forests, accompanied by a statement setting forth the information mentioned below.

But, before indicating the conditions on which water powers are leased or granted, it is necessary to briefly explain within what limits the Administration is permitted by juris-

prudence to act, and why it is sometimes necessary to obtain two titles: one from the Crown and the other from a private individual, for the same property.

Under present legislation, the rivers of this Province are considered as being of two classes:—

1. Those which are navigable and floatable;
2. Those which are neither navigable or floatable.

The beds of navigable and floatable rivers are vested in the Crown, as represented by the Provincial Government; and therefore the water powers form part of the public domain.

The beds of non-navigable and non-floatable rivers are either private property or form part of the public domain; they are private property when the lands bordering them have been granted by the Crown previous to the year 1884; on the contrary, they remain part of the Crown domain, as in the case of navigable rivers, if the lands bordering them have been sold since that date, because, under an act of the Legislature, reservation in favour of the Crown is always made, since that date, of a strip of land three chains wide on the banks of non-navigable and non-floatable rivers. From this it will be seen that in the case of non-navigable and non-floatable rivers, the fact of being a riparian owner makes one also the owner of the bed of the river and of the water power thereon.

Now the character of a navigable river not being defined with strict precision the consequence is that differences of opinion sometimes arise and, in order to avoid litigation, it may be to the advantage of the purchaser to obtain the Government's rights on the one hand, and those of the riparian owner on the other. Such cases evidently occur only in the older parts of the Province which have long been settled; the title from the Crown is sufficient everywhere else.

Therefore, in order to be able to utilize a water-fall for any purpose whatever, when there is any doubt as to the character of the rivers, the applicant should first of all send a petition to the Department of Lands and Forests, with a statement setting forth:—

- (a) His name, address and occupation.
- (b) A description of the lake or river from which the water is to be used, and stating in what range, township and county.
- (c) The height of the fall or rapid of such lake or river, at high and low stages, with corresponding discharges of water per second in cubic feet.
- (d) A plan of the river or lake, showing location of falls or rapids, and a sketch-plan of proposed works.

If the applicant be an incorporated company, the statement shall, in addition to the foregoing information, set forth:—

- (a) The name of the company.
- (b) The names of the directors and officers of the company, and their places of residence.

On receipt of the foregoing information, and after considering the same, the Minister of Lands and Forests will state the conditions on which the water power may be leased or granted, if he approves of the nature of the work to be carried out.

Such conditions usually depend on the importance of the water powers and on their geographical situation.

As a rule two alternatives are taken into consideration. If the water power cannot develop more than 200 horse-power, the Government sells, for a fixed price, a lot in the river bed with the lots of land on the banks if owning any, including the power that can be developed. This transaction may be made final by the granting of Letters-Patent and, when this is done, the grantee becomes entirely independent of the Government.

When the capacity exceeds 200 h.-p., the concession generally takes the form of an emphyteutic lease. The conditions of such leases are, as much as possible, similar and about as follows:—

1. Duration of the lease, from 25 to 99 years, according to the importance of the water power and to the amount of capital required for its development.
2. Payment of a yearly rental which does not vary during the term of the lease, for the land granted, counting from the date when the contract was signed.
3. An additional yearly charge of from 10 to 35 cents per h.-p., developed according to the geographical situation of the site of the water power; such charge being payable from the time the power is produced.
4. The above charge is subject to revision every 21 years counting from the signing of the contract.
5. Delay of two years for beginning works and two further years for producing power.
6. The lessee to make a deposit in money or in securities as a guarantee of good faith of the carrying out of the contract. Such deposit may be forfeited if the conditions are not fulfilled; but it may be repaid after a certain time, in the contrary case.
7. Lastly, the grantee must submit plans of his works, mills, etc., to the Department previous to their installation, and when such installation is completed, he must keep the Department informed of the quantity of power produced.

Of course the Government retains the right to verify the fulfillment of these conditions and, should they not be fulfilled, the lease may be cancelled.

When authorization is obtained by a lease from the Provincial Government, the grantee may proceed with his works on condition that he shall not interfere with navigation, if any is really carried on; for, in that case, the plans must be approved by the Federal Government whose duty it is to specially protect such navigation, and, consequently, to prevent the erection of any thing that may impede it.

For further information regarding water powers in Canada, application should be made direct to the following administrative officers of the Dominion and the various Provincial Governments:



Province of British Columbia: The Comptroller of Water Rights, Victoria, B.C.

Provinces of Manitoba, Saskatchewan and Alberta: The Superintendent of the Dominion Water Power Branch, Ottawa, Ont.

Province of Ontario: The Deputy Minister of Lands, Forests and Mines, Toronto, Ont; also, to the Secretary of the Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Province of Quebec: The Chief Engineer, Hydraulic Service, Department of Lands and Forests, Quebec, Que.

Province of New Brunswick: Surveyor-General of New Brunswick, Fredericton, N.B.

Province of Nova Scotia: The Secretary of the Nova Scotia Water Power Commission, Halifax, N.S.

